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# **ADVANCED TELEVISION TECHNOLOGY CENTER**

**Digital Audio Broadcasting**

**SCA Compatibility of the  
iBiquity Digital IBOC System  
in the FM Band**

**Summary of Test Results**

**Document #0116B**

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**Table of Contents**

Table of Contents .....	ii
List of Figures .....	iii
List of Tables .....	iv
1. Introduction.....	1
1.1. Scope .....	1
2. Description of the Test System and Parameters .....	2
2.1. Test Bed Description .....	2
2.2. FM Band Signals .....	2
2.2.1. Desired Analog .....	2
2.2.2. Desired Hybrid .....	3
2.2.3. Undesired Analog Interferer .....	3
2.2.3.1. Undesired Hybrid Interferer.....	4
2.2.3.2. Additive White Gaussian Noise .....	4
2.3. Baseband Audio .....	4
2.3.1. Standardized Interferer - Clipped Pink Noise .....	4
2.3.2. Standardized Interferer - Processed Rock .....	4
2.3.3. Standardized Interferer - LPF USASSI .....	4
3. Description of Test Receivers .....	6
4. Results Summary.....	7
4.1. Objective Results Summary.....	7
4.1.1. Single Interferers into the 67 kHz and the 92 kHz FM Analog SCA Subcarrier Channels (NRSC F/SC.1 and F/SC.2).....	8
4.1.2. Single Interferers into the 57 kHz RDS Subcarrier Channel (NRSC F/SC.3 and F/SC.4).....	18
4.1.3. Single Interferers into the 76 kHz DARC Subcarrier Channel (NRSC F/SC.3 and F/SC.4).....	20
4.1.4. Baseband Spectral Plots for IBOC Interference into the Host 67 and 92 kHz SCA Subcarrier Channels (NRSC J.3) .....	22
4.1.5. IBOC Interference into the Host 67 and 92 kHz SCA Subcarrier Channels (NRSC J.4).....	39
4.1.6. IBOC Interference into the Host 57 kHz RDS Subcarrier Channel (NRSC J.5) .....	42
4.1.7. IBOC Interference into the Host 76 kHz DARC Subcarrier Channel (NRSC J.6).....	43
4.2. Subjective Results Summary .....	44
4.2.1. Single Interferers into the 67 kHz and the 92 kHz FM Analog SCA Subcarrier Channels (NRSC F/SC.5 and F/SC.6).....	45
4.2.2. IBOC Interference into the Host 67 and 92 kHz SCA Subcarrier Channels (NRSC J.4.4 and J.4.5).....	53
5. Acknowledgements.....	56

## **List of Figures**

Figure 1 – Plot of Demodulator Composite Baseband Output with a Strong Analog Desired Signal, no AWGN, and 1 kHz Tone on the Main Audio (NRSC J.3).....	23
Figure 2 – Plot of Demodulator Composite Baseband Output with a Strong Hybrid Desired Signal, no AWGN, and 1 kHz Tone on the Main Audio (NRSC J.3).....	24
Figure 3 – Plot of Demodulator Composite Baseband Output with a Moderate Analog Desired Signal, no AWGN, and 1 kHz Tone on the Main Audio (NRSC J.3) .....	25
Figure 4 – Plot of Demodulator Composite Baseband Output with a Moderate Hybrid Desired Signal, no AWGN, and 1 kHz Tone on the Main Audio (NRSC J.3) .....	26
Figure 5 – Plot of Demodulator Composite Baseband Output with a Strong Analog Desired Signal, 30,000 K AWGN, and 1 kHz Tone on the Main Audio (NRSC J.3) .....	27
Figure 6 – Plot of Demodulator Composite Baseband Output with a Strong Hybrid Desired Signal, 30,000 K AWGN, and 1 kHz Tone on the Main Audio (NRSC J.3) .....	28
Figure 7 – Plot of Demodulator Composite Baseband Output with a Moderate Analog Desired Signal, 30,000 K AWGN, and 1 kHz Tone on the Main Audio (NRSC J.3).....	29
Figure 8 – Plot of Demodulator Composite Baseband Output with a Moderate Hybrid Desired Signal, 30,000 K AWGN, and 1 kHz Tone on the Main Audio (NRSC J.3).....	30
Figure 9 – Plot of Demodulator Composite Baseband Output with a Strong Analog Desired Signal, no AWGN, and Silence on the Main Audio (NRSC J.3).....	31
Figure 10 – Plot of Demodulator Composite Baseband Output with a Strong Hybrid Desired Signal, no AWGN, and Silence on the Main Audio (NRSC J.3).....	32
Figure 11 – Plot of Demodulator Composite Baseband Output with a Moderate Analog Desired Signal, no AWGN, and Silence on the Main Audio (NRSC J.3).....	33
Figure 12 – Plot of Demodulator Composite Baseband Output with a Moderate Hybrid Desired Signal, no AWGN, and Silence on the Main Audio (NRSC J.3).....	34
Figure 13 – Plot of Demodulator Composite Baseband Output with a Strong Analog Desired Signal, 30,000K AWGN, and Silence on the Main Audio (NRSC J.3) ..	35
Figure 14 – Plot of Demodulator Composite Baseband Output with a Strong Hybrid Desired Signal, 30,000K AWGN, and Silence on the Main Audio (NRSC J.3) ..	36
Figure 15 – Plot of Demodulator Composite Baseband Output with a Moderate Analog Desired Signal, 30,000K AWGN, and Silence on the Main Audio (NRSC J.3).....	37
Figure 16 – Plot of Demodulator Composite Baseband Output with a Moderate Hybrid Desired Signal, 30,000K AWGN, and Silence on the Main Audio (NRSC J.3).....	38

## **List of Tables**

Table 1 – Desired Test Signal Characteristics.....	3
Table 2 - Objective Test Results - Single Interferer into the 67 kHz SCA Subcarrier Channel of the Mc Martin TR-E5/55M Receiver (NRSC F/SC.1 and F/SC.2).....	8
Table 3 - Objective Results - Single Interferer into the 67 kHz SCA Subcarrier Channel of the repaired Mc Martin TR-E5/55M Receiver (NRSC F/SC.1 and F/SC.2) .....	10
Table 4 - Objective Test Results - Single Interferer into the 67 kHz SCA Subcarrier Channel of the Noryer 67 kHz Receiver (NRSC F/SC.1 and F/SC.2) .....	12
Table 5 - Objective Test Results - Single Interferer into the 92 kHz SCA Subcarrier Channel of the CozmoCom 92 kHz Receiver (NRSC F/SC.1 and F/SC.2) .....	14
Table 6 - Objective Test Results - Single Interferer into the 92 kHz SCA Subcarrier Channel of the ComPol SCA-BL 92 kHz Receiver (NRSC F/SC.1 and F/SC.2) .	16
Table 7 - Objective Test Results - Single Interferer into the 57 kHz RDS Subcarrier Channel of the Audemat RDS Analyzer Receiver (NRSC F/SC.3 and F/SC.4) ..	18
Table 8 - Objective Test Results - Single Interferer into the 76 kHz DARC Subcarrier Channel of the Sectra DRB-3000 Receiver (NRSC F/SC.3 and F/SC.4) .....	20
Table 9 –Objective Interference Test Scenarios – IBOC Interferers into Host 67 and 92 kHz SCA Subcarrier Channels – Baseband Plots (NRSC J.3).....	22
Table 10 - Objective Test Results – IBOC Interferer into Host 67 kHz SCA Subcarrier Channel for the Mc Martin TR-E5/55M Receiver Compatibility (NRSC J.4).....	39
Table 11 - Objective Test Results – IBOC Interferer into Host 67 kHz SCA Subcarrier Channel for the repaired Mc Martin TR-E5/55M Receiver Compatibility (NRSC J.4).....	40
Table 12 - Objective Test Results – IBOC Interferer into Host 67 kHz SCA Subcarrier Channel for the Norver 67 kHz Receiver (NRSC J.4).....	40
Table 13 - Objective Test Results – IBOC Interferer into Host 92 kHz SCA Subcarrier Channel for the CozmoCom 92 kHz Receiver (NRSC J.4).....	40
Table 14 - Objective Test Results – IBOC Interferer into Host 92 kHz SCA Subcarrier Channel for the ComPol SCA-BL Receiver (NRSC J.4).....	41
Table 15 - Objective Test Results – IBOC Interferer into Host 57 kHz RDS Subcarrier Channel of the Audemat RDS Analyzer Receiver (NRSC J.5) .....	42
Table 16 - Objective Test Results – IBOC Interferer into Host 76 kHz DARC Subcarrier Channel of the Sectra DRB-3000 Receiver (NRSC J.6) .....	43
Table 17 - Subjective Compatibility Test Scenarios - Single Interferers into the 67 and 92 kHz SCA Subcarrier Channels (NRSC F/SC.5 and F/SC.6) .....	45
Table 18 - Subjective Compatibility Test Scenarios – IBOC Interferers into the Host 67 and 92 kHz SCA Subcarrier Channels (NRSC J.4.4 & J.4.5) .....	53

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### **1. Introduction**

This report contains the results of tests conducted by the Advanced Television Technology Center (ATTC) on the **iBiquity Digital FM InBand On-Channel (IBOC) Digital Audio Broadcasting (DAB) System** during the period of April through August 2001.

#### **1.1. Scope**

The results reported in this document are collectively referred to as *SCA Compatibility Testing*. The objective of SCA compatibility testing is to evaluate and characterize the impact that an IBOC DAB system would have on the existing analog radio SCA services within the FM broadcast band. These tests are performed under controlled laboratory conditions that simulate interference due to digital sidebands on both adjacent channels and the analog host channel. This report provides data on the analog compatibility performance of SCA subcarrier channels and supplements data on the main channel reported previously<sup>1</sup>.

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<sup>1</sup> Digital Audio Broadcasting, Analog Compatibility and Digital Performance of the iBiquity IBOC System in the FM Band, Document No. 01-13, July 31, 2001, Advanced Television Technology Center, Inc.

## **2. Description of the Test System and Parameters**

### **2.1. Test Bed Description**

The ATTC DAB Test Bed configured for Analog Compatibility Testing is described in detail in ATTC Document No. 01-03<sup>2</sup>. The Test Bed was used to numerically quantify Signal-to-Noise (S/N) and Stereo Separation. The Test Bed was also used to produce digital audio recordings.

The performance of the ATTC Test Bed was verified according to the proof of performance plan detailed in ATTC Document No. 00-05<sup>3</sup>. The results of the proof are documented in ATTC Document No. 01-01<sup>4</sup>.

### **2.2. FM Band Signals**

#### **2.2.1. Desired Analog**

In all cases, the desired analog FM signal had the following characteristics:

- 1) Main channel modulation:
  - a) Stereo transmission
  - b) 75µs pre-emphasis
  - c) 10% pilot injection
- 2) Main Carrier:
  - a) 97.9 MHz
- 3) Power
  - a) Moderate: -62dBm
  - b) Strong: -47dBm

The test dependent signal characteristics are summarized in Table 1 . The audio material and subcarrier channels varied according one of four test types (III through VI). The 67 and 92 kHz subcarriers, if present, had a deviation of 5 kHz and a 150µs pre-emphasis.

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<sup>2</sup> Digital Audio Broadcasting, IBOC Laboratory Test Procedures – FM Band, Document No. 01-03, Revision 4.2, August 2001, Advanced Television Technology Center, Inc.

<sup>3</sup> Digital Audio Broadcasting, Test Bed Proof of Performance Plan, Document No. 00-05, Revision 1.1, December 2000, Advanced Television Technology Center, Inc.

<sup>4</sup> Digital Audio Broadcasting, Test Bed Proof of Performance Record, Document No. 01-01, Revision 1.0, January 2001, Advanced Television Technology Center, Inc.

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**Table 1 – Desired Test Signal Characteristics**

Type	Evaluation Type	Main Channel Audio		Subcarriers		
		Signal	Dynamic Processing	Frequency	Injection	Signal
III	Objective	CPN	N/A	67 kHz	10 %	400Hz tone
				92 kHz	10 %	LPF USASSI
IV	Subjective	MMW cut	Medium	67 kHz	10 %	CLM
				92 kHz	10 %	MaleA11 cut
V	Objective	CPN	N/A	57 kHz	3.0 %	RDS
VI	Objective	CPN	N/A	76 kHz	10 %	DARC

CLM = Critical Listening Material

CPN = Clipped Pink Noise

### 2.2.2. Desired Hybrid

This signal is defined as the spectral sum of an analog desired signal and the digital carriers as generated by an iBiquity Digital IBOC exciter in hybrid mode. The digital carriers utilize OFDM modulation. The sum of *all* digital carriers in the hybrid signal has an *average* power that is 20 dB below the average analog power.

### 2.2.3. Undesired Analog Interferer

In all cases, an undesired analog FM interferer had the following characteristics:

- 1) Main channel modulation:
  - a) Stereo transmission
  - b) 75µs pre-emphasis
  - c) 10% pilot injection
  - d) Test dependent audio
    - i) **Objective Tests (Type I)** Clipped Pink Noise with peaks equal to 90% modulation (67.5 kHz deviation). Pilot contributes 10% for total modulation = 100%.
    - ii) **Subjective Tests (Type II)** Processed Rock with peaks equal to 90% modulation (67.5 kHz deviation). Pilot contributes 10% for total modulation = 100%.
- 2) Subcarriers: None
- 3) Main Carrier:
  - a) For upper 1<sup>st</sup> adjacent: 98.1 MHz
  - b) For upper 2<sup>nd</sup> adjacent: 98.3 MHz
  - c) For co-channel: 97.9 MHz
  - d) For lower 1<sup>st</sup> adjacent: 97.7 MHz
  - e) For lower 2<sup>nd</sup> adjacent: 97.5 MHz

### **2.2.3.1. Undesired Hybrid Interferer**

In all cases, the undesired hybrid interferer was the spectral sum of an analog undesired signal and the digital carriers as generated by an IBOC exciter in hybrid mode. The analog portion of the signal had the same characteristics as outlined above. The sum of all digital carriers in the hybrid signal shall have an *average* power that is 20dB below the average analog power.

### **2.2.3.2. Additive White Gaussian Noise**

For SCA compatibility tests, the channels of interest were subjected to Additive White Gaussian Noise (AWGN) at a level of 30,000 degrees Kelvin.

## **2.3. Baseband Audio**

### **2.3.1. Standardized Interferer - Clipped Pink Noise**

In order to approximate the program material of a typical FM rock station; a CD recording was made of a ‘clipped pink noise’ signal. For cases where two simultaneous interferers are required a second CD recording was made. Each recording is played on two different CD players so that the signals are not correlated with each other in time.

### **2.3.2. Standardized Interferer - Processed Rock**

In addition to the clipped pink noise described above, a standard interferer was generated which simulates “processed rock” (which is assumed to be one of the worst interferers). While clipped pink noise does an excellent job of producing maximum deviation with a low peak to average ratio, as an interferer it is missing one critical component which many *human* listeners find objectionable – a beat. For this reason a processed rock interferer was used for the subjective tests.

As in the case of clipped pink noise, a CD recording of “processed rock” was made. For the cases of two simultaneous interferers, two sources were used with time offset from each other.

### **2.3.3. Standardized Interferer - LPF USASI**

In addition to the clipped pink noise and processed rock signals described above, another signal was developed, and labelled *LPF USASI*. This LPF USASI signal was designed to simulate program material that may be found on typical FM SCA services.

Basic USASI noise was developed by the United States of America Standards Institute. Its intended purpose is to simulate unprocessed program material. Since SCA services typically do not employ external processors, it was decided that USASI noise was appropriate to simulate program material that may be found on an SCA service. However, in order to simulate the bandwidth typically found on an SCA service, the USASI noise was passed through an additional 5kHz low pass

**Advanced Television Technology Center**

filter. This combination of USASI noise and low pass filtering results in a repeatable noise signal, which represents program material on a severely band-limited service. The resultant audio was termed *LPF USASI* for the purposes of these tests.

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### **3. Description of Test Receivers**

The following FM subcarrier receivers were used for the SCA compatibility tests:

<b>Radio Model No:</b>	<b>Type</b>	<b>Serial No:</b>
Mc Martin TR-E5/55M	67 kHz	286834
Norver 67 kHz	67 kHz Reading services	A0012461
CozmoCom 92 kHz	92 kHz	0073696
ComPol SCA-BL 92 kHz	92 kHz	Sample 1001
Audemar RDS Analyzer	57 kHz RDS	-
Sectra DRB-3000	76 kHz DARC	340002576

These receivers were provided to ATTC by the National Radio Systems Committee (NRSC). The objective tests (NRSC F/SC.1, F/SC.2, and J.4) were repeated for the Mc Martin receiver after the receiver was repaired by iBiquity Digital.

## **4. Results Summary**

### **4.1. Objective Results Summary**

The Weighted Quasi-Peak Signal-to-Noise Ratio (WQP SNR) of each receiver was objectively measured under various interference scenarios over a range of D/U signal ratios<sup>5</sup>. The test results are presented in the following series of tables. Each row of the tables represents one test designated by an ATTC test number. In the *Desired* column, the strength of the desired analog signal is indicated: *Strong* (-47 dBm) or *Moderate* (-62 dBm). In the interferer columns, the mode of the interferer is indicated: *Analog* or *Hybrid*. Each interferer also has a fixed D/U number (e.g. +6) next to it indicating that the strength of this interferer is fixed at that particular D/U ratio. The *AWGN* column indicates the presence or absence of a broadband noise floor. The *WQP SNR* column indicates the test result in dB.

The results for the RDS subcarrier channel receivers are expressed in terms of the measured Block Error Rate (BLER). The results for the DARC subcarrier channel receivers are expressed in terms of the measured Block Error Rate (BLER) before and after correction by the DARC receiver software. The two types of BLER measurements are presented as mean values, accompanied by a 95% confidence interval.

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<sup>5</sup> Throughout the remainder of this document, the following conventions are used: D refers to a desired analog signal; U refers to a single undesired interferer (which could be analog, or hybrid). If a D/U ratio is positive, then the desired signal has *more* power than the undesired signal.

## Advanced Television Technology Center

### **4.1.1. Single Interferers into the 67 kHz and the 92 kHz FM Analog SCA Subcarrier Channels (NRSC F/SC.1 and F/SC.2)**

Table 2 summarizes the results of the objective compatibility tests for single interferers into the 67 kHz FM analog SCA subcarrier channel (NRSC F/SC.1 and F/SC.2) of the Mc Martin TR-E5/55M receiver. iBiquity Digital discovered a problem with the Mc Martin receiver and repaired the receiver. Table 3 summarizes the results of the objective compatibility tests for the repaired Mc Martin receiver. The subjective test recordings from the Mc Martin receiver, described in Section 4.2, were made prior to the receiver repair.

Table 4 summarizes the results of the objective compatibility tests for single interferers into the 67 kHz FM analog SCA subcarrier channel of the Norver 67 kHz receiver. Table 5 summarizes the results of the objective compatibility tests for single interferers into the 92 kHz FM analog SCA subcarrier channel of the CozmoCom 92 kHz receiver. Table 6 summarizes the results of the objective compatibility tests for single interferers into the 92 kHz FM analog SCA subcarrier channel of the ComPol SCA-BL 92 kHz receiver.

**Table 2 - Objective Test Results Single Interferer into the 67kHz SCA Subcarrier Channel of the Mc Martin TR5/55M Receiver (NRSC F/SC.1 and F/SC.2)**

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	WQP SNR (dB)
1701		Analog: +16dB	67kHz: Moderate			None	27.8
1702		Hybrid: +16dB	67kHz: Moderate			None	27.5
1703		Analog: +6dB	67kHz: Moderate			None	17.2
1704		Hybrid: +6dB	67kHz: Moderate			None	17.1
1705		Analog: +16dB	67kHz: Moderate			30,000K	26.9
1706		Hybrid: +16dB	67kHz: Moderate			30,000K	26.8
1707		Analog: +6dB	67kHz: Moderate			30,000K	17.1
1708		Hybrid: +6dB	67kHz: Moderate			30,000K	17.1
1709			67kHz: Moderate	Analog: +16dB		None	21.9
1710			67kHz: Moderate	Hybrid: +16dB		None	21.8
1711			67kHz: Moderate	Analog: +6dB		None	8.3
1712			67kHz: Moderate	Hybrid: +6dB		None	9.2
1713			67kHz: Moderate	Analog: +16dB		30,000K	21.7
1714			67kHz: Moderate	Hybrid: +16dB		30,000K	21.8
1715			67kHz: Moderate	Analog: +6dB		30,000K	8.7
1716			67kHz: Moderate	Hybrid: +6dB		30,000K	7.8
1717	Analog: 0dB		67kHz: Moderate			None	35.8
1718	Hybrid: 0dB		67kHz: Moderate			None	35.8
1719	Analog: -10dB		67kHz: Moderate			None	35.7
1720	Hybrid: -10dB		67kHz: Moderate			None	35.7

## Advanced Television Technology Center

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	WQP SNR (dB)
1721	Analog: -20dB		67kHz: Moderate			None	35.3
1722	Hybrid: -20dB		67kHz: Moderate			None	34.0
1723	Analog: -30dB		67kHz: Moderate			None	31.5
1724	Hybrid: -30dB		67kHz: Moderate			None	4.0
1725	Analog: 0dB		67kHz: Moderate			30,000K	30.7
1726	Hybrid: 0dB		67kHz: Moderate			30,000K	30.6
1727	Analog: -10dB		67kHz: Moderate			30,000K	30.6
1728	Hybrid: -10dB		67kHz: Moderate			30,000K	30.6
1729	Analog: -20dB		67kHz: Moderate			30,000K	30.5
1730	Hybrid: -20dB		67kHz: Moderate			30,000K	30.1
1731	Analog: -30dB		67kHz: Moderate			30,000K	28.8
1732	Hybrid: -30dB		67kHz: Moderate			30,000K	3.3
1733			67kHz: Moderate		Analog: 0dB	None	35.8
1734			67kHz: Moderate		Hybrid: 0dB	None	35.7
1735			67kHz: Moderate		Analog: -10dB	None	35.7
1736			67kHz: Moderate		Hybrid: -10dB	None	35.0
1737			67kHz: Moderate		Analog: -20dB	None	35.3
1738			67kHz: Moderate		Hybrid: -20dB	None	2.8
1739			67kHz: Moderate		Analog: -30dB	None	1.9
1740			67kHz: Moderate		Hybrid: -30dB	None	0.1
1741			67kHz: Moderate		Analog: 0dB	30,000K	30.6
1742			67kHz: Moderate		Hybrid: 0dB	30,000K	30.5
1743			67kHz: Moderate		Analog: -10dB	30,000K	30.6
1744			67kHz: Moderate		Hybrid: -10dB	30,000K	30.4
1745			67kHz: Moderate		Analog: -20dB	30,000K	30.5
1746			67kHz: Moderate		Hybrid: -20dB	30,000K	3.0
1747			67kHz: Moderate		Analog: -30dB	30,000K	1.9
1748			67kHz: Moderate		Hybrid: -30dB	30,000K	0.0

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**Table 3 - Objective Results Single Interferer into the 67kHz SCA Subcarrier Channel of the repaired Mc Martin TRE5/55M Receiver (NRSCF/SC.1 and F/SC.2)**

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	WQP SNR (dB)
1701		Analog: +16dB	67kHz: Moderate			None	27.6
1702		Hybrid: +16dB	67kHz: Moderate			None	27.1
1703		Analog: +6dB	67kHz: Moderate			None	16.5
1704		Hybrid: +6dB	67kHz: Moderate			None	16.3
1705		Analog: +16dB	67kHz: Moderate			30,000K	26.9
1706		Hybrid: +16dB	67kHz: Moderate			30,000K	26.4
1707		Analog: +6dB	67kHz: Moderate			30,000K	16.3
1708		Hybrid: +6dB	67kHz: Moderate			30,000K	16.2
1709			67kHz: Moderate	Analog: +16dB		None	24.4
1710			67kHz: Moderate	Hybrid: +16dB		None	24.0
1711			67kHz: Moderate	Analog: +6dB		None	12.2
1712			67kHz: Moderate	Hybrid: +6dB		None	13.7
1713			67kHz: Moderate	Analog: +16dB		30,000K	23.9
1714			67kHz: Moderate	Hybrid: +16dB		30,000K	23.9
1715			67kHz: Moderate	Analog: +6dB		30,000K	13.8
1716			67kHz: Moderate	Hybrid: +6dB		30,000K	12.9
1717	Analog: 0dB		67kHz: Moderate			None	37.5
1718	Hybrid: 0dB		67kHz: Moderate			None	37.4
1719	Analog: -10dB		67kHz: Moderate			None	37.3
1720	Hybrid: -10dB		67kHz: Moderate			None	37.2
1721	Analog: -20dB		67kHz: Moderate			None	35.7
1722	Hybrid: -20dB		67kHz: Moderate			None	30.7
1723	Analog: -30dB		67kHz: Moderate			None	28.0
1724	Hybrid: -30dB		67kHz: Moderate			None	3.7
1725	Analog: 0dB		67kHz: Moderate			30,000K	31.3
1726	Hybrid: 0dB		67kHz: Moderate			30,000K	31.3
1727	Analog: -10dB		67kHz: Moderate			30,000K	31.2
1728	Hybrid: -10dB		67kHz: Moderate			30,000K	31.2
1729	Analog: -20dB		67kHz: Moderate			30,000K	30.7
1730	Hybrid: -20dB		67kHz: Moderate			30,000K	28.8
1731	Analog: -30dB		67kHz: Moderate			30,000K	26.6
1732	Hybrid: -30dB		67kHz: Moderate			30,000K	3.7
1733			67kHz: Moderate		Analog: 0dB	None	37.5
1734			67kHz: Moderate		Hybrid: 0dB	None	37.5
1735			67kHz: Moderate		Analog: -10dB	None	37.5
1736			67kHz: Moderate		Hybrid: -10dB	None	36.8
1737			67kHz: Moderate		Analog: -20dB	None	37.0
1738			67kHz: Moderate		Hybrid: -20dB	None	31.2
1739			67kHz: Moderate		Analog: -30dB	None	31.8
1740			67kHz: Moderate		Hybrid: -30dB	None	0.3

**Advanced Television Technology Center**

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	WQP SNR (dB)
1741			67kHz: Moderate		Analog: 0dB	30,000K	31.2
1742			67kHz: Moderate		Hybrid: 0dB	30,000K	31.2
1743			67kHz: Moderate		Analog: -10dB	30,000K	31.3
1744			67kHz: Moderate		Hybrid: -10dB	30,000K	31.1
1745			67kHz: Moderate		Analog: -20dB	30,000K	31.1
1746			67kHz: Moderate		Hybrid: -20dB	30,000K	29.0
1747			67kHz: Moderate		Analog: -30dB	30,000K	29.1
1748			67kHz: Moderate		Hybrid: -30dB	30,000K	0.3

**Advanced Television Technology Center**

**Table 4 - Objective Test Results Single Interferer into the 67kHz SCA Subcarrier Channel of the Norver 67 kHz Receiver (NRSVSC.1 and F/SC.2)**

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	WQP SNR (dB)
1701		Analog: +16dB	67kHz: Moderate			None	15.6
1702		Hybrid: +16dB	67kHz: Moderate			None	15.6
1703		Analog: +6dB	67kHz: Moderate			None	4.1
1704		Hybrid: +6dB	67kHz: Moderate			None	5.9
1705		Analog: +16dB	67kHz: Moderate			30,000K	15.3
1706		Hybrid: +16dB	67kHz: Moderate			30,000K	15.3
1707		Analog: +6dB	67kHz: Moderate			30,000K	5.1
1708		Hybrid: +6dB	67kHz: Moderate			30,000K	3.7
1709			67kHz: Moderate	Analog: +16dB		None	15.3
1710			67kHz: Moderate	Hybrid: +16dB		None	15.3
1711			67kHz: Moderate	Analog: +6dB		None	6.8
1712			67kHz: Moderate	Hybrid: +6dB		None	6.6
1713			67kHz: Moderate	Analog: +16dB		30,000K	15.4
1714			67kHz: Moderate	Hybrid: +16dB		30,000K	15.3
1715			67kHz: Moderate	Analog: +6dB		30,000K	7.1
1716			67kHz: Moderate	Hybrid: +6dB		30,000K	6.2
1717	Analog: 0dB		67kHz: Moderate			None	31.2
1718	Hybrid: 0dB		67kHz: Moderate			None	31.1
1719	Analog: -10dB		67kHz: Moderate			None	30.8
1720	Hybrid: -10dB		67kHz: Moderate			None	30.1
1721	Analog: -20dB		67kHz: Moderate			None	10.5
1722	Hybrid: -20dB		67kHz: Moderate			None	2.6
1723	Analog: -30dB		67kHz: Moderate			None	0.4
1724	Hybrid: -30dB		67kHz: Moderate			None	0.1
1725	Analog: 0dB		67kHz: Moderate			30,000K	24.8
1726	Hybrid: 0dB		67kHz: Moderate			30,000K	24.8
1727	Analog: -10dB		67kHz: Moderate			30,000K	24.8
1728	Hybrid: -10dB		67kHz: Moderate			30,000K	24.6
1729	Analog: -20dB		67kHz: Moderate			30,000K	10.0
1730	Hybrid: -20dB		67kHz: Moderate			30,000K	2.5
1731	Analog: -30dB		67kHz: Moderate			30,000K	0.4
1732	Hybrid: -30dB		67kHz: Moderate			30,000K	0.1
1733			67kHz: Moderate		Analog: 0dB	None	31.2
1734			67kHz: Moderate		Hybrid: 0dB	None	31.2
1735			67kHz: Moderate		Analog: -10dB	None	29.9
1736			67kHz: Moderate		Hybrid: -10dB	None	29.2
1737			67kHz: Moderate		Analog: -20dB	None	17.6
1738			67kHz: Moderate		Hybrid: -20dB	None	4.9
1739			67kHz: Moderate		Analog: -30dB	None	1.6
1740			67kHz: Moderate		Hybrid: -30dB	None	0.4

## Advanced Television Technology Center

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	WQP SNR (dB)
1741			67kHz: Moderate		Analog: 0dB	30,000K	24.9
1742			67kHz: Moderate		Hybrid: 0dB	30,000K	24.9
1743			67kHz: Moderate		Analog: -10dB	30,000K	24.5
1744			67kHz: Moderate		Hybrid: -10dB	30,000K	24.3
1745			67kHz: Moderate		Analog: -20dB	30,000K	16.6
1746			67kHz: Moderate		Hybrid: -20dB	30,000K	5.0
1747			67kHz: Moderate		Analog: -30dB	30,000K	1.6
1748			67kHz: Moderate		Hybrid: -30dB	30,000K	0.5

**Advanced Television Technology Center**

**Table 5 - Objective Test Results Single Interferer into the 92 kHz SCA Subcarrier Channel of the CozmoCom 92 kHz Receiver (NRSC.1 and F/SC.2)**

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	WQP SNR (dB)
1749		Analog: +16dB	92kHz: Moderate			None	17.2
1750		Hybrid: +16dB	92kHz: Moderate			None	13.3
1751		Analog: +6dB	92kHz: Moderate			None	8.2
1752		Hybrid: +6dB	92kHz: Moderate			None	7.9
1753		Analog: +16dB	92kHz: Moderate			30,000K	15.3
1754		Hybrid: +16dB	92kHz: Moderate			30,000K	15.4
1755		Analog: +6dB	92kHz: Moderate			30,000K	8.2
1756		Hybrid: +6dB	92kHz: Moderate			30,000K	7.9
1757			92kHz: Moderate	Analog: +16dB		None	18.4
1758			92kHz: Moderate	Hybrid: +16dB		None	16.8
1759			92kHz: Moderate	Analog: +6dB		None	8.1
1760			92kHz: Moderate	Hybrid: +6dB		None	7.8
1761			92kHz: Moderate	Analog: +16dB		30,000K	17.4
1762			92kHz: Moderate	Hybrid: +16dB		30,000K	17.5
1763			92kHz: Moderate	Analog: +6dB		30,000K	7.9
1764			92kHz: Moderate	Hybrid: +6dB		30,000K	7.9
1765	Analog: 0dB		92kHz: Moderate			None	29.0
1766	Hybrid: 0dB		92kHz: Moderate			None	29.0
1767	Analog: -10dB		92kHz: Moderate			None	29.0
1768	Hybrid: -10dB		92kHz: Moderate			None	28.6
1769	Analog: -20dB		92kHz: Moderate			None	28.6
1770	Hybrid: -20dB		92kHz: Moderate			None	13.2
1771	Analog: -30dB		92kHz: Moderate			None	4.3
1772	Hybrid: -30dB		92kHz: Moderate			None	0.6
1773	Analog: 0dB		92kHz: Moderate			30,000K	27.3
1774	Hybrid: 0dB		92kHz: Moderate			30,000K	27.2
1775	Analog: -10dB		92kHz: Moderate			30,000K	27.3
1776	Hybrid: -10dB		92kHz: Moderate			30,000K	27.0
1777	Analog: -20dB		92kHz: Moderate			30,000K	27.0
1778	Hybrid: -20dB		92kHz: Moderate			30,000K	16.1
1779	Analog: -30dB		92kHz: Moderate			30,000K	4.1
1780	Hybrid: -30dB		92kHz: Moderate			30,000K	0.7
1781			92kHz: Moderate		Analog: 0dB	None	29.0
1782			92kHz: Moderate		Hybrid: 0dB	None	28.9
1783			92kHz: Moderate		Analog: -10dB	None	28.9
1784			92kHz: Moderate		Hybrid: -10dB	None	28.0
1785			92kHz: Moderate		Analog: -20dB	None	27.4
1786			92kHz: Moderate		Hybrid: -20dB	None	22.7
1787			92kHz: Moderate		Analog: -30dB	None	6.5
1788			92kHz: Moderate		Hybrid: -30dB	None	2.1

### Advanced Television Technology Center

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	WQP SNR (dB)
1789			92kHz: Moderate		Analog: 0dB	30,000K	27.3
1790			92kHz: Moderate		Hybrid: 0dB	30,000K	27.2
1791			92kHz: Moderate		Analog: -10dB	30,000K	27.1
1792			92kHz: Moderate		Hybrid: -10dB	30,000K	26.6
1793			92kHz: Moderate		Analog: -20dB	30,000K	26.2
1794			92kHz: Moderate		Hybrid: -20dB	30,000K	23.2
1795			92kHz: Moderate		Analog: -30dB	30,000K	6.5
1796			92kHz: Moderate		Hybrid: -30dB	30,000K	2.2

**Advanced Television Technology Center**

**Table 6 - Objective Test Results Single Interferer into the 92kHz SCA Subcarrier Channel of the ComPol SCABL 92 kHz Receiver (NRSGF/SC.1 and F/SC.2)**

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	WQP SNR (dB)
1749		Analog: +16dB	92kHz: Moderate			None	5.6
1750		Hybrid: +16dB	92kHz: Moderate			None	5.9
1751		Analog: +6dB	92kHz: Moderate			None	2.1
1752		Hybrid: +6dB	92kHz: Moderate			None	2.2
1753		Analog: +16dB	92kHz: Moderate			30,000K	5.2
1754		Hybrid: +16dB	92kHz: Moderate			30,000K	5.2
1755		Analog: +6dB	92kHz: Moderate			30,000K	2.1
1756		Hybrid: +6dB	92kHz: Moderate			30,000K	2.1
1757			92kHz: Moderate	Analog: +16dB		None	5.3
1758			92kHz: Moderate	Hybrid: +16dB		None	5.2
1759			92kHz: Moderate	Analog: +6dB		None	2.0
1760			92kHz: Moderate	Hybrid: +6dB		None	1.9
1761			92kHz: Moderate	Analog: +16dB		30,000K	5.1
1762			92kHz: Moderate	Hybrid: +16dB		30,000K	4.7
1763			92kHz: Moderate	Analog: +6dB		30,000K	2.1
1764			92kHz: Moderate	Hybrid: +6dB		30,000K	2.0
1765	Analog: 0dB		92kHz: Moderate			None	27.9
1766	Hybrid: 0dB		92kHz: Moderate			None	27.8
1767	Analog: -10dB		92kHz: Moderate			None	27.8
1768	Hybrid: -10dB		92kHz: Moderate			None	25.5
1769	Analog: -20dB		92kHz: Moderate			None	25.7
1770	Hybrid: -20dB		92kHz: Moderate			None	3.4
1771	Analog: -30dB		92kHz: Moderate			None	10.9
1772	Hybrid: -30dB		92kHz: Moderate			None	0.4
1773	Analog: 0dB		92kHz: Moderate			30,000K	18.5
1774	Hybrid: 0dB		92kHz: Moderate			30,000K	18.5
1775	Analog: -10dB		92kHz: Moderate			30,000K	18.4
1776	Hybrid: -10dB		92kHz: Moderate			30,000K	18.2
1777	Analog: -20dB		92kHz: Moderate			30,000K	17.8
1778	Hybrid: -20dB		92kHz: Moderate			30,000K	3.3
1779	Analog: -30dB		92kHz: Moderate			30,000K	9.3
1780	Hybrid: -30dB		92kHz: Moderate			30,000K	0.4
1781			92kHz: Moderate		Analog: 0dB	None	27.9
1782			92kHz: Moderate		Hybrid: 0dB	None	27.6
1783			92kHz: Moderate		Analog: -10dB	None	27.8
1784			92kHz: Moderate		Hybrid: -10dB	None	24.8
1785			92kHz: Moderate		Analog: -20dB	None	24.4
1786			92kHz: Moderate		Hybrid: -20dB	None	3.3
1787			92kHz: Moderate		Analog: -30dB	None	12.9
1788			92kHz: Moderate		Hybrid: -30dB	None	0.3

**Advanced Television Technology Center**

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	WQP SNR (dB)
1789			92kHz: Moderate		Analog: 0dB	30,000K	18.4
1790			92kHz: Moderate		Hybrid: 0dB	30,000K	18.5
1791			92kHz: Moderate		Analog: -10dB	30,000K	18.4
1792			92kHz: Moderate		Hybrid: -10dB	30,000K	18.1
1793			92kHz: Moderate		Analog: -20dB	30,000K	17.6
1794			92kHz: Moderate		Hybrid: -20dB	30,000K	3.4
1795			92kHz: Moderate		Analog: -30dB	30,000K	10.6
1796			92kHz: Moderate		Hybrid: -30dB	30,000K	0.3

## Advanced Television Technology Center

### **4.1.2. Single Interferers into the 57 kHz RDS Subcarrier Channel (NRSC F/SC.3 and F/SC.4)**

Table 7 summarizes the results of the objective compatibility tests for single interferers into the 57 kHz RDS subcarrier channel of the Audemat RDS Analyzer receiver (NRSC F/SC.3 and F/SC.4).

**Table 7 - Objective Test Results Single Interferer into the 5kHz RDS Subcarrier Channel of the Audemat RDS Analyzer Receiver (NRSC F/SC.3 and F/SC.4)**

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	BLER (%)
2101		Analog: +26dB	RDS: Moderate			None	0.00 ± 0.00
2102		Hybrid: +26dB	RDS: Moderate			None	0.00 ± 0.00
2103		Analog: +16dB	RDS: Moderate			None	0.00 ± 0.00
2104		Hybrid: +16dB	RDS: Moderate			None	0.00 ± 0.00
2105		Analog: +6dB	RDS: Moderate			None	0.00 ± 0.00
2106		Hybrid: +6dB	RDS: Moderate			None	0.00 ± 0.00
2107		Analog: +26dB	RDS: Moderate		30,000K	0.00 ± 0.00	
2108		Hybrid: +26dB	RDS: Moderate		30,000K	0.00 ± 0.00	
2109		Analog: +16dB	RDS: Moderate		30,000K	0.00 ± 0.00	
2110		Hybrid: +16dB	RDS: Moderate		30,000K	0.00 ± 0.00	
2111		Analog: +6dB	RDS: Moderate		30,000K	0.00 ± 0.00	
2112		Hybrid: +6dB	RDS: Moderate		30,000K	0.00 ± 0.00	
2113			RDS: Moderate	Analog: +26dB		None	0.00 ± 0.00
2114			RDS: Moderate	Hybrid: +26dB		None	0.00 ± 0.00
2115			RDS: Moderate	Analog: +16dB		None	0.00 ± 0.00
2116			RDS: Moderate	Hybrid: +16dB		None	0.00 ± 0.00
2117			RDS: Moderate	Analog: +6dB		None	0.00 ± 0.00
2118			RDS: Moderate	Hybrid: +6dB		None	0.00 ± 0.00
2119			RDS: Moderate	Analog: +26dB		30,000K	0.00 ± 0.00
2120			RDS: Moderate	Hybrid: +26dB		30,000K	0.00 ± 0.00
2121			RDS: Moderate	Analog: +16dB		30,000K	0.00 ± 0.00
2122			RDS: Moderate	Hybrid: +16dB		30,000K	0.00 ± 0.00
2123			RDS: Moderate	Analog: +6dB		30,000K	0.00 ± 0.00
2124			RDS: Moderate	Hybrid: +6dB		30,000K	0.00 ± 0.00
2125	Analog: 0dB		RDS: Moderate			None	0.00 ± 0.00
2126	Hybrid: 0dB		RDS: Moderate			None	0.00 ± 0.00
2127	Analog: -10dB		RDS: Moderate			None	0.00 ± 0.00
2128	Hybrid: -10dB		RDS: Moderate			None	0.00 ± 0.00
2129	Analog: -20dB		RDS: Moderate			None	0.00 ± 0.00
2130	Hybrid: -20dB		RDS: Moderate			None	0.00 ± 0.00
2131	Analog: -30dB		RDS: Moderate			None	0.00 ± 0.00
2132	Hybrid: -30dB		RDS: Moderate			None	0.00 ± 0.00
2133	Analog: 0dB		RDS: Moderate		30,000K	0.00 ± 0.00	
2134	Hybrid: 0dB		RDS: Moderate		30,000K	0.00 ± 0.00	
2135	Analog: -10dB		RDS: Moderate		30,000K	0.00 ± 0.00	
2136	Hybrid: -10dB		RDS: Moderate		30,000K	0.00 ± 0.00	
2137	Analog: -20dB		RDS: Moderate		30,000K	0.00 ± 0.00	
2138	Hybrid: -20dB		RDS: Moderate		30,000K	0.00 ± 0.00	
2139	Analog: -30dB		RDS: Moderate		30,000K	0.00 ± 0.00	
2140	Hybrid: -30dB		RDS: Moderate		30,000K	0.00 ± 0.00	
2141			RDS: Moderate	Analog: 0dB	None	0.00 ± 0.00	
2142			RDS: Moderate	Hybrid: 0dB	None	0.00 ± 0.00	
2143			RDS: Moderate	Analog: -10dB	None	0.00 ± 0.00	
2144			RDS: Moderate	Hybrid: -10dB	None	0.00 ± 0.00	
2145			RDS: Moderate	Analog: -20dB	None	0.00 ± 0.00	
2146			RDS: Moderate	Hybrid: -20dB	None	0.00 ± 0.00	
2147			RDS: Moderate	Analog: -30dB	None	0.00 ± 0.00	
2148			RDS: Moderate	Hybrid: -30dB	None	0.00 ± 0.00	

### Advanced Television Technology Center

#	Lower 2nd adj.	Lower 1st adj.	Desired	Upper 1st adj.	Upper 2nd adj.	AWGN	BLER (%)
2149			RDS: Moderate		Analog: 0dB	30,000K	0.00 ± 0.00
2150			RDS: Moderate		Hybrid: 0dB	30,000K	0.00 ± 0.00
2151			RDS: Moderate		Analog: -10dB	30,000K	0.00 ± 0.00
2152			RDS: Moderate		Hybrid: -10dB	30,000K	0.00 ± 0.00
2153			RDS: Moderate		Analog: -20dB	30,000K	0.00 ± 0.00
2154			RDS: Moderate		Hybrid: -20dB	30,000K	0.00 ± 0.00
2155			RDS: Moderate		Analog: -30dB	30,000K	0.00 ± 0.00
2156			RDS: Moderate		Hybrid: -30dB	30,000K	0.00 ± 0.00

## Advanced Television Technology Center

### 4.1.3. Single Interferers into the 76 kHz DARC Subcarrier Channel (NRSC F/SC.3 and F/SC.4).

Table 8 summarizes the results of the objective compatibility tests for single interferers into the 76 kHz DARC subcarrier channel (NRSC F/SC.3 and F/SC.4) for the Sectra DRB-3000. The desired signal strength is moderate.

**Table 8 - Objective Test Results Single Interferer into the 76kHz DARC Subcarrier Channel of the Sectra DRB3000 Receiver (NRSC F/SC.3 and F/SC.4)**

#	Lower 2 <sup>nd</sup> adj	Lower 1 <sup>st</sup> adj	Desired	Upper 1 <sup>st</sup> adj	Upper 2 <sup>nd</sup> adj	AWGN	BLER Before Correction (%)	BLER After Correction (%)
2301		Analog: +26dB	DARC			None	0.00 ± 0.00	0.00 ± 0.00
2302		Hybrid: +26dB	DARC			None	0.00 ± 0.00	0.00 ± 0.00
2303		Analog: +16dB	DARC			None	1.85 ± 0.28	0.00 ± 0.00
2304		Hybrid: +16dB	DARC			None	1.97 ± 0.29	0.00 ± 0.00
2305		Analog: +6dB	DARC			None	80.03 ± 0.86	5.04 ± 0.31
2306		Hybrid: +6dB	DARC			None	81.56 ± 0.91	5.24 ± 0.58
2307		Analog: +26dB	DARC			30,000K	0.00 ± 0.00	0.00 ± 0.00
2308		Hybrid: +26dB	DARC			30,000K	0.00 ± 0.00	0.00 ± 0.00
2309		Analog: +16dB	DARC			30,000K	1.95 ± 0.36	0.00 ± 0.00
2310		Hybrid: +16dB	DARC			30,000K	1.97 ± 0.25	0.00 ± 0.00
2311		Analog: +6dB	DARC			30,000K	80.38 ± 1.02	5.00 ± 0.51
2312		Hybrid: +6dB	DARC			30,000K	81.13 ± 1.15	5.23 ± 0.48
2313			DARC	Analog: +26dB		None	0.00 ± 0.00	0.00 ± 0.00
2314			DARC	Hybrid: +26dB		None	0.00 ± 0.00	0.00 ± 0.00
2315			DARC	Analog: +16dB		None	0.79 ± 0.19	0.00 ± 0.00
2316			DARC	Hybrid: +16dB		None	0.95 ± 0.24	0.00 ± 0.00
2317			DARC	Analog: +6dB		None	70.62 ± 1.10	1.48 ± 0.27
2318			DARC	Hybrid: +6dB		None	72.34 ± 1.17	1.46 ± 0.27
2319			DARC	Analog: +26dB		30,000K	0.00 ± 0.00	0.00 ± 0.00
2320			DARC	Hybrid: +26dB		30,000K	0.00 ± 0.00	0.00 ± 0.00
2321			DARC	Analog: +16dB		30,000K	1.06 ± 0.22	0.00 ± 0.00
2322			DARC	Hybrid: +16dB		30,000K	1.19 ± 0.24	0.00 ± 0.00
2323			DARC	Analog: +6dB		30,000K	71.22 ± 1.03	1.50 ± 0.33
2324			DARC	Hybrid: +6dB		30,000K	72.58 ± 1.18	1.53 ± 0.18
2325	Analog: 0dB		DARC			None	0.00 ± 0.00	0.00 ± 0.00
2326	Hybrid: 0dB		DARC			None	0.00 ± 0.00	0.00 ± 0.00
2327	Analog: -10dB		DARC			None	0.00 ± 0.00	0.00 ± 0.00
2328	Hybrid: -10dB		DARC			None	0.00 ± 0.00	0.00 ± 0.00
2329	Analog: -20dB		DARC			None	0.00 ± 0.00	0.00 ± 0.00
2330	Hybrid: -20dB		DARC			None	0.00 ± 0.00	0.00 ± 0.00
2331	Analog: -30dB		DARC			None	0.01 ± 0.03	0.00 ± 0.00
2332	Hybrid: -30dB		DARC			None	0.05 ± 0.05	0.00 ± 0.00
2333	Analog: 0dB		DARC			30,000K	0.00 ± 0.00	0.00 ± 0.00
2334	Hybrid: 0dB		DARC			30,000K	0.00 ± 0.00	0.00 ± 0.00
2335	Analog: -10dB		DARC			30,000K	0.00 ± 0.00	0.00 ± 0.00
2336	Hybrid: -10dB		DARC			30,000K	0.00 ± 0.00	0.00 ± 0.00
2337	Analog: -20dB		DARC			30,000K	0.00 ± 0.00	0.00 ± 0.00
2338	Hybrid: -20dB		DARC			30,000K	0.00 ± 0.00	0.00 ± 0.00
2339	Analog: -30dB		DARC			30,000K	0.07 ± 0.05	0.00 ± 0.00
2340	Hybrid: -30dB		DARC			30,000K	0.07 ± 0.05	0.00 ± 0.00
2341			DARC	Analog: 0dB		None	0.00 ± 0.00	0.00 ± 0.00
2342			DARC	Hybrid: 0dB		None	0.00 ± 0.00	0.00 ± 0.00
2343			DARC	Analog: -10dB		None	0.00 ± 0.00	0.00 ± 0.00
2344			DARC	Hybrid: -10dB		None	0.00 ± 0.00	0.00 ± 0.00
2345			DARC	Analog: -20dB		None	0.00 ± 0.00	0.00 ± 0.00
2346			DARC	Hybrid: -20dB		None	0.00 ± 0.00	0.00 ± 0.00
2347			DARC	Analog: -30dB		None	0.00 ± 0.00	0.00 ± 0.00

## Advanced Television Technology Center

#	Lower 2 <sup>d</sup> adj	Lower F <sup>c</sup> adj	Desired	Upper F <sup>c</sup> adj	Upper 2 <sup>d</sup> adj	AWGN	BLER Before Correction (%)	BLER After Correction (%)
2348			DARC		Hybrid: -30dB	None	0.00 ± 0.00	0.00 ± 0.00
2349			DARC		Analog: 0dB	30,000K	0.00 ± 0.00	0.00 ± 0.00
2350			DARC		Hybrid: 0dB	30,000K	0.00 ± 0.00	0.00 ± 0.00
2351			DARC		Analog: -10dB	30,000K	0.00 ± 0.00	0.00 ± 0.00
2352			DARC		Hybrid: -10dB	30,000K	0.00 ± 0.00	0.00 ± 0.00
2353			DARC		Analog: -20dB	30,000K	0.00 ± 0.00	0.00 ± 0.00
2354			DARC		Hybrid: -20dB	30,000K	0.00 ± 0.00	0.00 ± 0.00
2355			DARC		Analog: -30dB	30,000K	0.00 ± 0.00	0.00 ± 0.00
2356			DARC		Hybrid: -30dB	30,000K	0.00 ± 0.00	0.00 ± 0.00

Desired Signal: Moderate